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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

CENTRAL STATES FOREST EXPERIMENT STATION

ANNUAL INVESTIGATIVE REPORT FOR 1933

AND PROGRAM FOR 1934

(Calendar Years)

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Branch of Research

Forest Service - U. S. Department of Agriculture

CENTRAL STATES FOREST EXPERIMENT STATION

208-209 Horticulture and Forestry Building
Ohio State University, Columbus, Ohio

ANNUAL INVESTIGATIVE REPORT FOR 1933

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CENTRAL STATES REGION

Ohio
Indiana
Illinois
Iowa
Missouri
Western Kentucky
Western Tennessee
Northern Arkansas

The Central States Forest Experiment Station is one of eleven regional stations maintained by the Branch of Research of the Forest Service, U. S. Department of Agriculture. Created by act of Congress, the Station was established at Columbus in 1927, in cooperation with Ohio State University and the Ohio Agricultural Experiment Station. Studies and investigations are conducted by the Station to determine essential facts concerning the forest problems of the central hardwood region. Its research program is guided by the Central States Forest Research Council, the members of which represent various interests in the Middle West. The territory served by the Station includes eight states: Ohio, Indiana, Illinois, Iowa, Missouri, western Kentucky, western Tennessee, and northern Arkansas.

CENTRAL STATES FOREST EXPERIMENT STATION STAFF - 1933

FOREST SERVICE PERSONNEL

Willis M. Baker	Director
John T. Auten	Silviculturist
Leonard F. Kellogg	Assoc. Silviculturist
Ralph K. Day	Assist. Silviculturist
John G. Kuenzel	Junior Forester
Boyd B. Parker	Senior Clerk
Charlotte Huston	Clerk-Stenographer

Temporary Personnel

Mabel Petty -(Temp. transfer - Jan. to June)	Statistical Assistant
Clyde R. Cochran (NIRA Appoint. - Nov. 1, 1933)	Assistant to Technician
Hugh R. Moore (NIRA Appoint. - Nov. 6, 1933)	Crew Leader (Ark.)
Oliver D. Diller (May to September)	Field Assistant
C. E. Anderson (May to July)	" "
W. H. Allison (April to July)	" "
Esmond Sears (May to July)	" "
Seward Legge -(CWA Appoint. - Dec. 11, 1933)	Statistical Assistant
John G. Wood " " " " "	" "
Brice Schumacher" " " " "	Office Assistant
Harvey Brucker " " " " "	" "
Edna L. Kirk " " " " "	" "
L. Maude Heaney " " " " "	" "
Claude E. Sutton" " " " "	Crew Leader (Ind.)

BUREAU OF ENTOMOLOGY

Ralph C. Hall	Assistant Entomologist
B. H. Wilford - (ECW Appoint. - Oct. 9, 1933)	ECW Entomologist
William H. Cummings (April to July)	Temporary Field Aid
Noel D. Wygant (April to July)	Temporary Field Assistant
Herbert Secrest (July - August)	Temporary Office Assistant
S. L. Jordon (CWA Appoint. - Dec. 12, 1933)	Temporary Crew Leader (Ohi-

CENTRAL STATES FOREST RESEARCH COUNCIL

1933

Alexander Thomson, Pres. C. V. Anderson, Vice-Pres. W. M. Baker, Sec.

OHIO

C. Vivian Anderson, Insurance, 1205 Union Trust Bldg., Cincinnati.
C. A. Dyer, Agricultural Legislative Agent, Southern Hotel, Columbus.
Edmund Secrest, State Forester, Wooster.
Alexander Thomson, Champion Coated Paper Company, Hamilton.
Dr. E. N. Transeau, Botany Department, Ohio State University, Columbus.

INDIANA

Charles H. Barnaby, Lumberman, Greencastle.
Dr. Stanley Coulter, Conservation Commission, Indianapolis.
Dr. J. H. Skinner, Purdue Agri. Exper. Sta., Lafayette.
Tom L. Wheeler, Editor, Indiana Farmer's Guide, Huntington.
Ralph Wilcox, State Forester, Indianapolis.

ILLINOIS

W. F. Lodge, Izaac Walton League, Monticello.
R. B. Miller, State Forester, Springfield.
Earl C. Smith, Illinois Agri. Asso., 608 S. Dearborn St., Chicago.
Dr. William Trelease, Botany Dept., Univ. of Illinois, Urbana.

IOWA

Chas. E. Hearst, Iowa Farm Bureau, 410 Observatory Bldg., DesMoines.
G. B. MacDonald, Forestry Dept., Iowa State College, Ames.

MISSOURI

R. W. Brown, Missouri Farm Bureau, Jefferson City.
E. E. Pershall, Moss Tie Company, St. Louis.
Paul C. Stark, Nurseryman, Louisiana.

KENTUCKY

Chas. F. Huhlein, Bernheim Estate, 139 S. First St., Louisville.
W. E. Jackson, Jr., State Forester, Frankfort.

TENNESSEE

James O. Hazard, State Forester, Nashville.

CENTRAL STATES FOREST EXPERIMENT STATION

ANNUAL INVESTIGATIVE REPORT FOR 1933

AND PROGRAM FOR 1934

GENERAL

Progress in 1933. For the Central States Forest Experiment Station 1933 has been a year of great contrasts, during which real progress has been made. After an active spring season of field work, the regular budget of the Station was reduced approximately 36 per cent on July 1, in accordance with the federal policy of economy and retrenchment. As a result, nearly all field work was terminated, field assistants were dismissed, and the Station staff took advantage of the opportunity to engage in the analysis and compilation of data and in the writing of reports. Later in the fall authorization was received to participate actively in several of the Administration's emergency programs to relieve unemployment, and several new projects were initiated. More than fifty extra workers have already been given employment in 1933, and others will be added as rapidly as work projects can be developed after the first of the new year.

During these periods of fluctuation between extreme curtailment and emergency expansion, the Station has attempted to engage in work of the greatest permanent benefit to its regional program of forest research. The main achievements of the year may be summarized as follows:

1. Four experimental forest areas for the use of the Station have been established within National and State forests, and a good start has been made toward their improvement and development as permanent working centers and branch stations.

2. The number of research publications of the Station has been increased very considerably to make the results of investigations immediately available to those who use them.

3. The field work of several current research projects has been completed, and with the extra office help now employed much of the data analysis, compilation, and report writing should be finished during the winter. With this accomplished, the Station will be able to devote more time and effort to work on urgent problems of reforestation and forest management. This, in our opinion, is most essential in view of recent developments in the field of forest conservation.

The New Deal in Forestry. Within the past year the entire aspect of the forestry situation in the Central States has changed so remarkably and so rapidly that it has been difficult to keep pace in thought or in action. Many factors have contributed to this development: a more general realization of the necessity for an expanded forestry program for waste land utilization, as emphasized by the U. S. Forest Service in its Copeland Report; the creation of the Tennessee Valley Authority; the establishment of National Forests in Illinois, Missouri, and Kentucky; the forest management, reforestation and erosion control projects of the Civilian Conservation Corps; additional conservation projects undertaken by public agencies under the NRA and CWA emergency programs; and last but not least, the measures proposed in the Lumber Code to ensure forest protection, conservative logging, and sustained forest yield on privately-owned woodlands, with increased public cooperation. These developments have come so suddenly that many forestry problems and lines of work, formerly considered of slight immediate importance even by foresters, now require prompt action if we are to avoid demoralizing delays, costly errors, and wasted opportunities.

The Need for Research and Extension. To meet the situation brought about by the rapid expansion of forest and waste land administration, there is a critical need for more facts from research regarding reforestation and silvicultural management. In the past most of the forest planting in the region has been confined to Corn Belt soils and species; relatively little is known of the problems of reforesting the eroded, unglaciated waste lands that formerly produced, but are now unfitted for, hardwoods, and which for the most part lie between the natural ranges of northern and southern conifers. Little intensive silvicultural management of woodlands has ever been attempted in the Central States; consequently much information must be secured before satisfactory methods can be recommended. There are climatic and soil problems peculiar to the region. Efforts in reforestation and forest management must be accompanied, and should be preceded, by a definite expansion of research to provide the facts necessary for successful accomplishment.

Moreover, information must be disseminated as it becomes available, to all classes of land owners and operators, if successful forest practices are to be established. Within a region where so much of the land is owned by farmers, it becomes obvious that the general adoption of forestry methods is dependent to a large degree upon the recommendations of agricultural advisors. The farm forestry program of the Middle West needs the increased cooperation of agricultural institutions and agencies, particularly in the field of education and extension.

BRANCH STATIONS - EXPERIMENTAL FORESTS

The preliminary work of the Station since 1927 has consisted largely of region-wide surveys of forest conditions, and investigative projects extensive in scope. From the beginning it has been realized, however, that our projects would tend gradually to become more intensive as specific problems of major importance developed from the general reconnaissance, and that with this change would come the need for experimental areas for permanent study plots, with working centers and branch stations. Recent developments in the forestry situation have brought about this change abruptly; accordingly, during 1933 the Station has made a decided effort to secure the establishment of experimental areas for its use.

Arkansas. In October an area designated as the Sylamore Branch Station was selected in north-central Arkansas, on the eastern division of the Ozark National Forest. This 2,925-acre experimental forest, typical of the Ozark oak and shortleaf pine types, lies within a wilderness region of rough topography along the headwaters of Livingston Creek. It provides excellent opportunities for studies of silvicultural management under conditions of protection from fire unusually favorable for the region. A working plan of research investigations will be prepared by the Station in cooperation with the Forest Supervisor and the Regional Office.

The construction of improvements and the development of this area, authorized under an allotment of NRA funds, were started early in November under the direction of John G. Kuenzel. Since November from 20 to 25 local men have been given emergency employment. A four-room headquarters house and a combined office-garage-storehouse building have been completed, as well as the necessary water and sanitation systems. Two and one-quarter miles of telephone line have been erected, and a phone installed. Nine miles of fire-breaks and trails have been built along roads and boundary lines. Approximately ten acres of old fields comprising the headquarters site have been enclosed with a rail fence to exclude hogs and cattle. The area is already accessible over good National Forest roads.

Valuable cooperative assistance with these projects has been extended to Kuenzel by the Forest Supervisor's office, by Ranger Guy Cox, and by Superintendent Sellers of CCC Camp Hedges. Mr. Hugh Moore, formerly a ranger on the Ozark National Forest, has been employed as a crew leader. Former field assistant Clyde R. Cochran has been appointed as Assistant to Technician, primarily to make a survey, map, and timber estimate of the experimental forest. This project has been started, but will receive more attention after January 1, now that most of the building construction has been completed. NRA funds are also available for work of timber stand improvement and forest management research, which will be undertaken during 1934 under Kuenzel's direction.

Illinois. Baker and Day located an area suitable for a branch station and experimental forest on the Shawnee National Forest Purchase Unit in southeastern Illinois. An excellent tract containing forest and waste land conditions typical of the region was found between Elizabethtown and Karber's Ridge. With the approval of the Regional Forester, Supervisor Ball has agreed to expedite federal acquisition in this locality, in order that the experimental area may be established in time to permit the Station to construct improvements and to undertake other development and investigative work with the NRA funds now available. It is not expected that these projects can be undertaken before spring.

Indiana. Final approval has been given to the agreement with the Indiana Department of Conservation for the establishment of a 160-acre experimental area on the Morgan-Monroe State Forest. This tract, located along Hacker Creek, provides an area of abandoned farm land for reforestation experiments, and stands of young hardwoods for studies of growth and intensive management. A comprehensive plan of investigative projects to be undertaken will be formulated in cooperation with the State Forester and the Department of Forestry of the Purdue Agricultural Experiment Station. The temporary employment of ten local men has been authorized by the Civil Works Administration for the purpose of surveying and mapping this experimental area, marking boundaries, constructing fire-breaks, trails, etc. This work was started on December 11 under the supervision of Ralph Day. The local crew leader is Claude E. Sutton of Indianapolis, a graduate forester formerly in the employ of the U. S. Forest Service.

Ohio. Final approval has also been given to the agreement with the Board of Control of the Ohio Agricultural Experiment Station for the establishment of a 120-acre experimental area on the Shawnee State Forest in southern Ohio. This tract provides a typical sample of southern Ohio forest conditions where various management investigations can be carried on advantageously in cooperation with the State Forester. Later in the spring we hope to be able to do some improvement work on this area with labor provided under the NRA authorization.

Other Areas. The establishment of these four experimental forests in Ohio, Indiana, Illinois, and Arkansas provides the Station with about all the areas it can develop and work on to advantage under its present budget. Mr. Alexander Thomson, President of the Forest Research Council, has offered the Station the use of his forest plantations at Old Timbers in southeastern Indiana for studies of planting methods and growth. Since the Station has received no emergency funds for use in Missouri, no action has been taken at this time toward requesting the establishment of a branch station on the National Forest lands now being acquired in the southern part of that State.

STATION PUBLICATIONS IN 1933

The following publications of the Station have appeared in print during the past year:

Natural Regeneration of Farmwoods Following the Exclusion of Livestock. Purdue Bulletin #368. A cooperative publication by R. K. Day of this Station and Daniel DenUyl of Purdue Agricultural Experiment Station.

Yellow Poplar Characteristics, Growth and Management. By former director E. F. McCarthy. Tech. U.S.D.A. Bull. #356.

Porosity and Water Absorption of Forest Soils. By John T. Auten. Jour. of Agr. Research. Vol. 46. No. 11. June 1, 1933. Reprints.

The Story of Hay Holler. By John T. Auten. September issue of American Forests. A popular article dealing with land abandonment in the Central States.

Forestry and Land Use in the Central States. By Ralph K. Day. Journal of Forestry, January, 1934. Vol. XXXII. No. 1. Pages 57-62.

Following the great expansion of black locust planting for erosion control under President Roosevelt's Emergency Conservation Program, the Station prepared mimeographed Station Notes as emergency progress reports, to contribute available information.

1. Collection of Black Locust Seed. By John G. Kuenzel.
2. Extraction of Black Locust Seed. By Leonard F. Kellogg.
3. Black Locust Planting for Erosion Control. By Leonard F. Kellogg.
4. Site Requirements of Black Locust. By John T. Auten.
5. Suggestions for Locust Borer Control. By Ralph C. Hall.
6. Growth of Black Locust. By Leonard F. Kellogg.
7. Volume Table of Black Locust in Cubic Feet. By Leonard F. Kellogg.
8. Porosity and Water Absorption of Forest Soils. By John T. Auten.

The following articles have been submitted for publication in the Journal of Forestry, and are expected to appear early in 1934.

Calcium and Magnesium Losses from the Cultivation of Forest Land. By John T. Auten.

The Climbing Method for Taking Tree Measurements in Plantations in the Central States. By L. F. Kellogg.

A short article on the carrying capacity phase of the farm woodland grazing study was prepared by Day for the U.S.D.A. Agricultural Yearbook for 1934.

FOREST PLANTING (Fp-1)

Leonard F. Kellogg

During 1933 Kellogg's forest plantation studies were considerably delayed by his assignments to special projects. He did not return from Washington until March, after having spent approximately six months on the Copeland Report, and in April he was appointed ECW Liaison Officer for the 5th Corps Area. Since then he has spent part of his time at Fort Hayes, Columbus, assisting Army officials and State forestry organizations in the conduct of the Emergency Conservation program.

Black Locust Tables. The stem measurements of 396 black locusts obtained during the 1932 field season have been checked, curved, and planimetered; a volume table giving contents in cubic feet has been constructed and mimeographed as Station Note No. 7. The table checks in the aggregate against the basic data to 0.01 per cent, but the average deviation of 393 of the 396 trees is ± 9.0 per cent. Progress has also been made in the construction of tables giving merchantable volumes in board feet, in numbers of fence posts of various sizes, and in 4-foot bolts, in which form locust is commonly utilized. Taper curves of locust are now being prepared to aid in the construction of these product tables. All of the locust volume tables should be completed early in 1934.

In December, when additional CWA assistants became available, work was started in tabulating the data of the 254 black locust yield plots previously established. This project is being pushed as rapidly as possible, but in view of other obligations the construction of yield tables may not be completed during 1934.

Several Station Notes dealing with black locust were prepared as part of the Station's contribution to the conservation projects of the ECW program.

Seed Collection and Extraction. Early in September a shortage of commercial locust seed, brought about by the increased use of this species for erosion control planting, led to inquiries from several sources regarding the best methods of collecting and extracting native seed. Some necessarily hasty experiments in locust seed collection and extraction led the publication of the results as Station Notes 1 and 2. A pea-sheller, a clover-huller, and a separator with concaves set for wheat threshing were tried, and the latter proved to be the most satisfactory. Professor J. B. Park and Mr. Paul P. Preston of the O.S.U. Agronomy Department cooperated very helpfully in making available the equipment necessary for this project. Similar tests conducted by Olsen of the Southern Forest Experiment Station at Holly Springs, Mississippi, substantiated Kellogg's conclusions and provided more detailed data on the yield and cost of locust seed.

For the experiments mentioned above and to furnish a small supply of good native seed for reforestation studies of the Station, about six bushels each of locust pods and shortleaf pine cones, as well as a small quantity of pitch pine cones, were collected by Kellogg in southern Ohio. Data regarding the yield of seed of these species are given in the tables following.

(a) Shortleaf and Pitch Pine Seed Production

Kelley's Run, Vinton County, Ohio - Crop of 1933

Species	Green Wt. of Cones	Dry Wt. of Extracted Cones	Wt. of Seed and Wings	Net Wt. of Clean Seed	Equivalent Seed Prod. Per Cwt. Green Cones
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Shortleaf Pine	173½	91	9.328	7.141	4.116
Pitch Pine	36	-	0.515	0.385	1.069

(b) Black Locust Seed Production

Highland County, Ohio - Crop of 1933

Tree	Gross dry Wt. of Pods with sack	Approximate Volume of Pods	Net Wt. of Cleaned Seed	Equivalent Seed Prod. Per Cwt. dry Pods	Equivalent Seed Prod. Per Bushel dry Pods
No.	Lbs.	Bu.	Lbs.	Lbs.	Lbs.
1	18½	2½	3.5	18.9	1.40
2	16½	2½	3.4	20.6	1.36
3	11½	1½	2.45	21.3	1.63
Total	46½	6½	9.35	20.1	1.44

Expansion of Reforestation Studies. Up to the present time the Fp-1 project of the Station has been directed toward the study of growth and yield in the older plantations of the Middle West, in the belief that a record of past performance would be very helpful in the preparation of future planting plans. For the most part the older plantations have consisted of hardwoods planted on level prairie and Corn Belt soils, yet it has recently become apparent that a great expansion in forest planting is required on the worn-out, eroding, and abandoned lands bordering and south of the Ohio and Missouri rivers, within the rough, unglaciated territory of the Central States. With the exception of black locust, it is probable that few hardwood species can thrive under the deteriorated conditions of site that now exist, and various species of pine appear best adapted for reforestation in this region. Little is known of the best species or methods of planting to use; accordingly the urgent need for further reforestation studies is most apparent.

In 1934 the Station will begin investigations of this nature, especially in southern Indiana and southern Illinois, where emergency funds have been made available for reforestation studies on recently acquired experimental areas. The plans for this work are now being formulated.

FOREST SITE STUDIES (M-1)

John T. Auten

Porosity and Water Absorption of Forest Soils. The report of Dr. Auten's study to determine the relative loss of porosity and water absorptive capacity of field soils as compared with forest soils, has been published in the Journal of Agricultural Research, June 1, 1933. (Vol. 46, No. 11.) Since the Station was provided with only a very few reprints of this article, it has been summarized as a 4-page mimeographed Station Note (No. 8) to meet requests for information on this subject.

Base Exchange Study. A preliminary report on the relation of calcium and magnesium losses to soil changes in the transition from forest to field conditions appeared in the 1933 annual report of the American Soil Survey Association. (Bulletin XIV, Page 14.) A more comprehensive article dealing with the replacement of these bases following the clearing and cultivation of forest land, and the relation of the changed site conditions to tree growth, was submitted by Auten to the Journal of Forestry for publication during 1933.

Study of Plantation Sites. The purpose of this study is to determine the factors of site which exert important influence on the establishment and growth of tree species adapted for extensive planting in the Central States. The immediate objective has been the correlation of Kellogg's growth and yield data of planted black walnut and black locust with their site requirements. Auten began the study of black walnut plantation sites in 1932 and completed the field work in June, 1933, with a total of 120 plots recorded. During the 1933 spring season he also completed the field work on a similar study of 135 plots of planted black locust. To correlate this project with the locust borer investigation, Auten and Hall conducted their spring field work jointly, with two field assistant crews composed of Cummings, Allison, Wygant, and Sears.

The choice of walnut and locust for this study affords a project of considerable scope, with direct bearing upon the site requirements of many upland hardwood species, since walnut is known to be very exacting in its requirements and locust is regarded as one of the most adaptable hardwood species. In the case of both walnut and locust, soil structure and the condition of the subsoil have been found to exert a major influence on growth and yield; soil fertility alone is no final criterion of site quality, and soil reaction is apparently of minor importance. Observations of site conditions and soil profile studies conducted in the field have been supplemented by data analysis and laboratory tests of soil samples collected from the plots. The preliminary draft of a final report of this study has been prepared.

A progress report entitled "Site Requirements of Black Locust" was mimeographed in October as Station Note No. 4, to make available to planters of black locust information regarding its adaptability for erosion control planting.

Continuation of Site Studies in 1934. Analysis of data and laboratory soil tests will be continued to completion with the aid of CWA assistants, and the final report on the site requirements of black walnut and black locust will be prepared for publication during the winter.

The importance of continuing and expanding site studies in conjunction with reforestation and silvicultural management investigations cannot be too strongly emphasized. In their silvical studies of tree establishment and growth, foresters in the past have paid too little attention to the conditions of soil and site which have been largely responsible for success or failure. In view of the rapidly expanding programs of forest planting in the Central States, including erosion control planting by the Civilian Conservation Corps and the extensive reforestation necessary on the newly acquired National Forests in Illinois and Missouri, more information regarding the influence of site conditions on tree establishment and growth is urgently needed. On the Station's recently acquired experimental areas in Ohio, Indiana, Illinois and Arkansas, an inventory of soil and site conditions is necessary to supplement the timber estimate, as a basis for silvical studies in the future. So far as possible under the handicap of continued curtailment of funds for research, and with the restrictions in the use of emergency unemployment funds, these site studies will be carried on during 1934.

FARM WOODLAND MANAGEMENT (M-2)

Ralph K. Day

Woodland Grazing Reconnaissance. The report covering the reconnaissance survey of woodland grazing in the Central States is approaching completion. Much of the earlier statistical data, compiled by Dr. Meyer and based upon the 1925 Census, has been reworked by Day using 1930 Census figures. Several of the new graphs and charts prepared in connection with the grazing study have contributed so strikingly to an understanding of the land utilization problem of the region that they have been used in other reports. (1) Pressure of administrative work in connection with various emergency relief projects during 1933 has materially delayed the completion of this grazing reconnaissance manuscript, but it is expected to be ready for publication in 1934.

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(1) Forestry and Land Use in the Central States. By Ralph K. Day. Journal of Forestry, January, 1934. Vol. XXXII. No. 1. Pages 57-62.

Regeneration of Grazed Woodlands. The study of the ability of overgrazed farm woodlands to regenerate naturally following the removal of livestock has now definitely assumed the status of periodic remeasurement of permanent plots. The bulletin (2) published by the Purdue Agricultural Experiment Station in the spring covered the cooperative work of the two Stations on the earlier and more extensive phases of this problem. Field assistant Oliver Diller, assisted by Eugene D. Marshall of the Purdue Station, continued the measurement of permanent sample plots during the early part of the 1933 field season. A portion of the plots will require remeasurement in 1934.

During the latter part of the summer the field crew engaged in an intensive study of the various site factors influencing the germination, establishment and survival of tree reproduction in the more heavily grazed woodlands. Under the general direction of Day, Diller has analyzed the field data and has conducted a number of laboratory tests since his return to Ohio State University. Some of the data will be used by him in connection with his dissertation for the advanced degree which he expects to receive in March, 1934. Later on he and Day plan to prepare a report for publication.

Livestock Management. The three-year experiment dealing with the livestock carrying capacity of farmwoods, carried on in cooperation with the Purdue Agricultural Experiment Station at the Pinney-Purdue Farm near Wanatah, Indiana, has been completed. DenUyl, of the Purdue Station, has compiled the results of these tests and he and Day are preparing a manuscript covering this study. If the finances of the Stations permit, it is hoped that plans may be agreed upon for continuing other phases of the carrying capacity study in 1934. The actual cash value of the forage in woodland pastures remains to be determined, as well as the degree of grazing which will permit the recovery of forest conditions.

Farm Woodland Management. With the shifting of the emphasis of the grazing study from extensive establishment of plots to more intensive study of permanent plots, it was anticipated early in 1933 that a start should be made to study intensively the entire problem of farm woodland management, including silvicultural methods of cutting. With this plan in mind, Day started the project in northern Ohio, in cooperation with the Ohio Agricultural Experiment Station. Some thirty plots were established during the spring season under the direction of Day and Extension Forester Dean of the Ohio Station, with the assistance of Kuenzel, Diller, and Anderson. Unfortunately this work was terminated on July 1 because of the severe cut in the research allotment of the Station. Continuance in 1934 depends upon the restoration of these funds.

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(2) The Natural Regeneration of Farmwoods Following the Exclusion of Livestock. By Ralph K. Day and Daniel DenUyl. Cooperative Bulletin 368, Purdue Agr. Exper. Station.

UPLAND FOREST MANAGEMENT (M-3)

John G. Kuenzel

Chestnut Oak Regeneration. In the spring of 1933 Kuenzel again remeasured the chestnut oak regeneration plots established in 1929 at Crystal Spring and Rock House in southern Ohio, and on the Clark County State Forest in southern Indiana. The regeneration phase of this study is now completed, but Kuenzel has been delayed in preparing the report because of his participation in emergency administrative work during the year. Observations regarding the growth of chestnut oak reproduction on the clear-cut and partially cut Indiana plots will be continued to determine the comparative growth of seedling and sprout reproduction.

Upland Forest Management. Up to the present time only very meager funds have been available for silvical investigations in the management of the upland forest types of the unglaciated region of the Central States. Now, however, excellent opportunities exist for the establishment of permanent growth and management plots on the Station's experimental forest areas established in 1933, and limited funds for the initiation of this work are available through the emergency NRA allotments. Kuenzel will establish a series of permanent management plots on the Sylamore Experimental Forest in Arkansas early in 1934, and similar work will be undertaken on the other areas as rapidly as circumstances permit. The Mill-Tract cutting area on the Clark County State Forest in Indiana is scheduled for its first remeasurement in the fall or winter of 1934.

LOCUST BORER INVESTIGATION

Ralph C. Hall,
Bureau of Entomology

After having spent several weeks in Washington during the winter, Hall returned to the Station in April. His cooperation with Auten in the spring field work of the locust site study has already been mentioned. In October Dr. B. H. Wilford was assigned as ECW Entomologist to work with Dr. Hall on the locust borer investigation.

Survival of Locust Borer Larvae. Fifty sample plots, located in Ohio, Indiana, Illinois, Kentucky, Tennessee, Michigan, Pennsylvania, and New York, were used for this study. Each plot contained twenty trees, with five in each crown class. In the early spring a count of all young larvae was made on each tree. Wet patches on the bark or exudating frass were taken to denote points of attack. A subsequent examination in the late fall and winter was made and all fresh emergence holes were counted to determine the survival per cent of larvae for the summer period. Spring and fall measurements of tree diameters were also taken to determine the rate of growth coincident with the development of the locust borer larvae. The results of this study clearly demonstrate that the more rapid the rate of growth of the tree, the less is the survival of the borer larvae.

Seedling Planting. Black locust seedlings, one-year-old, which had been grown by Hall from locally collected seed from severely-injured trees and from those that appeared to be immune to attack, were planted in alternate rows. They will be observed to determine if there is any hereditary difference in susceptibility to borer injury in the two classes of seedlings. These seedlings were planted in the early spring on three different classes of site: a very poor site on the Ohio State University property at Columbus; a medium quality site near Butler, Ohio; and a very good site near Rushville, Ill. The area at Columbus was inundated during an unusual spring flood for a period of about a week, and not a single seedling survived. Survival on the other two areas was very good.

Root Propagation. Some experimenting was done during the past season in propagating black locust by root cuttings, to regenerate varieties of black locust that have escaped locust borer injury. Spring cuttings were planted near Bath, Ill. on a sandy soil, and while they sprouted reasonably well, practically none of them survived the summer, due to severe exposure. The sprouts appeared to have been killed by sun scalding at the point where they came through the sand. Considerable work on propagating locust by root cuttings is planned during the coming winter and spring in cooperation with the Bureau of Plant Industry.

Control of the Locust Borer by Silvicultural Methods. Two clear cutting experiments, to induce vigorous sprouting in an attempt to control the locust borer, were conducted on badly injured stands in Illinois during the early spring. One area was located on sandy soil near Bath, Ill., and the other on fine loam soil near Jerseyville, Ill. The cuttings were made late in April; in early July the sprouts on the sandy soil had attained a maximum height of 6 feet, while those on the loam had attained a maximum height of 9 feet. At that time two sample plots of 1/10 acre each were established on each cutting. One plot was treated by removing all but the best sprout in each clump and the other plot was left for control. Two additional sample plots of 1/10 acre each were also established on the sandy area: on one of the plots a heavy thinning was made to determine its effect on subsequent rate of growth and survival of locust borer larvae. Further work of this nature is contemplated in Ohio and Indiana during the coming winter.

Development of an Experimental Area. Mr. S. C. Carnes of Cambridge, Ohio has turned over 53 acres to the Bureau of Entomology for use as an experimental area. This area is ideally suited for such a purpose, due to the fact that the major part of it was planted to black locust in the spring of 1930, and these trees are just beginning to reach the size when they will be susceptible to attack by the locust borer. This area ranges in elevation from 900 to 1125 feet and all exposures are represented. The planted locust on this area ranges in height from about 3 to 25 feet. The area also has natural locust on it, some of which has been badly injured and some of which has practically no injury. A topographic and type map has been made for this area and a survey has been started to locate the different sites. A detailed soil map is also contemplated. A field crew is at present at work making the inventory, and when this is completed, various cutting experiments for locust borer control will be initiated. This and similar projects for locust borer control, as well as remeasurement of established plots, are included in the plan of work for 1934.

ADMINISTRATION

Personnel. There have been no changes in the regular personnel of the Station during 1933. The salary reduction of 8 1/3 per cent in effect at the beginning of the year was increased to 15 per cent on April 1, and has continued since that date. Miss Mabel Petty, transferred to the Station on January 15 for statistical work, returned to the Forest Taxation Inquiry on June 15. Five of the six field assistants employed in April or May were necessarily dismissed on July 1 because of the reduction in the Station's allotments for the new fiscal year. Fortunately they were able to secure employment immediately as foremen in the CCC camps of Ohio and Indiana.

Mention has been made of the 25 extra employees secured in November for NRA field work in Arkansas, and the 26 field and office workers employed in December under the authority of the Civil Works Administration. At a time when nearly all available unemployed foresters and trained forest workers have been absorbed by the CCC camps, the Station has been exceedingly fortunate, with the helpful cooperation of local employment authorities, to secure very satisfactory help for these emergency projects.

Central States Forest Research Council. No formal meeting of the Forest Research Council has been held during 1933 owing to unsettled conditions. Contacts have been maintained by means of reports and correspondence, and most of the members have been visited by the Director during the course of field trips within the region. Recommendations for reappointments and new appointments have not been acted upon in Washington in time for the 1934 Council to be listed in this report.

Headquarters - Equipment. The extra office room provided by Ohio State University last year is now utilized to capacity, and the Station has urgent need for more laboratory and storage space. A request for increased accommodations is now being given consideration by the University authorities. The facilities of the Highway Soils Laboratory have been made available to Dr. Auten by the courtesy of Professor Eno and Director Hitchcock of the Engineering Experiment Station, of which Baker is a member of the Technical Advisory Committee. In March an old Dodge truck was turned in on the purchase of a Plymouth sedan, and in October a new Dodge half-ton truck was purchased. Very little additional equipment has been purchased during the year, except that needed for emergency employment projects.

Public Relations. During 1933 members of the Station attended ten important forestry or conservation meetings within the region, and upon four occasions gave talks or read papers. Eight other lectures were given before various groups on the Ohio State campus, in addition to a radio broadcast over Station WOSU in cooperation with the professor of forestry. Auten, who was a member of the committee on organic and forest soils, American Soil Survey Association, in 1933, was made chairman of the committee for 1934. Kellogg was a member of the Committee on nominations, Ohio Valley Section, S. A. F. Kuenzel was made faculty advisor of the Buckeye Forestry Club. Baker was appointed to the executive committees of the Central States Forestry Congress and the Ohio Forestry Association, to the nominating committee of the Society of American Foresters, and chairman of the committee on organization of the Ohio Valley Section, S. A. F.

Miscellaneous. Baker and Kellogg remained in Washington working on the Copeland Report until March. Baker returned to Washington in April for the ECW conference. In May Kellogg was appointed ECW liaison officer for the 5th Corps area, and since then has spent considerable time at Fort Hayes, Columbus, working with the Army authorities on ECW work. In December Day and Baker devoted considerable time to work on the provision of Article X of the lumber code, as it applies to the Central and Southern Hardwood regions.

Distribution of Expenditures 1933-1934

Project	Fiscal Year 1933 7-1-32 to 6-30-33	First Half F.Y.1934 7-1-33 to 12-31-33	Estimated For Second Half F.Y.1934 1-1-34 to 6-30-34
M-1 Forest Sites	7,065.01	3,247.86	3,500.00
M-2 Farm Woodlands (a)	5,772.18	2,036.22	1,142.32
M-3 Forest Management	1,366.71	814.65	1,500.00
Fp-1 Planting	5,121.74	2,466.09	3,000.00
Copeland Report	7,897.30	---	---
ECW Program (b)	530.18	548.01	500.00
CWA Program (b)	---	391.62	500.00
NIRA Program (b)	---	678.23	1,000.00
	$27,753.12	$10,182.68	$11,142.32
Locust Borer (Bur. of Ent.)	7,830.00	2,420.00	2,520.00

(a) During 1933 the Purdue Agricultural Experiment Station contributed approximately $1,500 in time and equipment to the farm woodland grazing study.

(b) Represents expenditures of Station's regular funds for administration of these special emergency projects, but does not include the extra allotments made for these projects.